**A. Title**

Application for Permit for Scientific Purposes under the Endangered Species Act of 1973.

**B. Species**

Chinook salmon, *Oncorhynchus tshawytcha* Puget Sound ESU

**C. Date of Permit Application**

January 4, 2005
Study duration: 2006 – 2010 (5 years)

**D. Applicant Identity**

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**Funding Sources/Sponsors**

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**Disposition of Dead Specimens (tissues)**

All samples will be analyzed by research scientists within the National Marine Fisheries Service. Samples for chemical analysis will be the responsibility of the Environmental Assessment Program (information below). Remaining sample material will be archived at the Northwest Fisheries Science Center for use by internal researchers and their collaborators. Contact for archival samples:

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## F. Project Description, Purpose, and Significance

The focus of this study is to monitor a number of the proposed restoration sites along the Puget Sound shoreline, from near the Hiram Chittenden Locks north to Everett to determine fish presence, individual fish health, and the degree of toxic chemical contamination of fish at restored sites. The major goal is to determine pre-restoration baseline data that is so often lacking in most restoration efforts. The primary species of focus will be juvenile outmigrant salmon and a resident bottom dwelling species, such as English sole (*Pleuronectes vetulus*) or Pacific staghorn sculpin (*Leptocottus armatus*), but overall fish assemblage composition will be evaluated as well. In addition to habitat utilization and fish health, chemical analysis of fish tissue and stomach contents, as well as sediments, for toxic contaminants (e.g., PAHs, PCBs) will be performed to assess contaminant exposure at all sites. Blood serum samples from juvenile Chinook salmon will be analyzed for elevated vitellogenin levels in juvenile salmon as an indicator of exposure to estrogenic compounds.

Coastal and nearshore estuarine ecosystems provide a vital role as rearing habitat for early life stages of a large number of marine species (Beck et al. 2001, Beck et al. 2003, 2003, Day et al. 1989, Levy & Northcote 1982, Rice et al. 2005) and some of these areas may provide a disproportionate contribution to adult populations. Even small nearshore areas can provide significant contributions (Beck et al. 2001). While these systems represent some of the most diverse and complex habitats in the marine environment, they are also some of the most heavily impacted by human activities (Beck et al. 2001, 2003, Cederholm et al. 2001, Rice et al. 2005, Shreffler et al. 1990). Changes to these habitats can result in complex and cumulative effects on estuarine fish populations. Nearshore ecosystems can be particularly important in the recovery of species at risk (Feist et al. 2003), such as listed Pacific Northwest salmon stocks that all use these areas as juveniles (Aitkin 1998, Cederholm et al. 2001, Conley 1977, Cornu & Sadro 2002, Gray et al. 2002, Levy & Northcote 1982, Meyer 1979, Rice et al. 2005, Simenstad et al. 1982).

Restoration of degraded marine environments has become a major focus of regulatory and non-regulatory responses to anthropogenic alterations (Rice et al. 2005). Monitoring of restoration activities is an important step in determining their effectiveness, particularly in light of the large sums of money (e.g. $3,364,929 were spent for five restoration sites in the Commencement Bay area, www.darp.noaa.gov/northwest/cbay) spent to improve degraded habitat (Roni, et al. 2002, Steel et al. 2003). The restoration of degraded nearshore and intertidal areas of Puget Sound has become the focus of several regulatory and non-regulatory agencies (e.g. City of Everett, U.S. Army Corps of Engineers, King County).

Restoration of degraded nearshore and estuarine habitats tends to focus on reproduction of the physical attributes of the original system (Gray et al. 2002), with more limited attention paid to problems associated with anthropogenic contamination. Many of these monitoring efforts are of poorly designed, lack long-term collection of data, have no initial baseline data, or are deficient in appropriate reference sites (Beck et al. 2003, Michener 1997, Roni et al. 2002). A major problem with restoration projects of this type is that little or no consideration is given to evaluating conditions before the restoration efforts begin (Cordell et al 2001, Rice et al. 2005, Roni et al. 2002). Many of these studies also lack a biological component, including chemical contaminant exposure of biota at restoration sites in urban environments. The inclusion of contaminant monitoring is particularly valuable, and a component that is often neglected even in restoration of urban sites. Exposure to chemical contaminants such as PCBs, PAHs and DDTs has been associated with an increased risk of immunosuppression, impaired thyroid function, reduced growth, reproductive impairment, and delayed mortality in salmon and other fishes (Bravo et al. 2004, Johnson et al. 2002, Loge et al. 2005, Meador et al. 2002), while exposure to current use pesticides and copper interferes with olfactory function and may disrupt feeding, predator avoidance, or homing behaviors (Scholz et al. 2003; Baldwin et al. 2004, others). Determination of fish assemblages is also an excellent tool for the assessment and monitoring of water resources (Simon 1999). The lack of pre-restoration analysis of either fish assemblage or chemical analysis of fish or sediments introduces significant limitations on the interpretation of the effects of restoration efforts.

## G. Project Methodology

1. Sediments will be collected from six sites (see Table 2, Figure 1), four pre-restoration sites and two reference sites, for chemical analysis (Sloan et al. 2004). Fish assemblage/habitat usage data (species identification, abundance, length/weight on selected species) will be collected using a 37 m x 2.4 m (10 mm mesh size) floating "Puget Sound" beach seine with 20 m polypropylene lines attached at either end. Beach seine sets will be deployed using a 17 ft. (5.2 m) Boston Whaler, with three sets performed at all sites. Indices to be computed will include species richness, abundance, and catch-per-unit-effort (CPUE) for all species at all sites, and size frequency distributions for salmonids.

   Fish health surveys will be conducted at all sites where juvenile salmonids (Chinook, coho, chum and pink) are encountered in conjunction with a resident bottom dwelling species, such as English sole or Pacific staghorn sculpin. To evaluate the health of juvenile salmonids, individual condition factors will be calculated, and whole body lipid content will be determined. To evaluate chemical contaminant exposure in salmon, stomach contents samples will be collected for measurement of contaminant in the diet, and bile samples will be collected for measurement of metabolites of aromatic hydrocarbons (Krahn et al. 1994). Whole body analysis (Sloan et al. 2004) for selected toxic contaminants will be also performed. These body burden data will then be compared against residue effects threshold (RET) values recently that are protective of salmonid health (Meador et al., 2001). In addition, serum will be collected and analyzed for elevated vitellogenin levels in juvenile salmon as an indicator of exposure to estrogenic compounds. Up to 30 marked and unmarked juvenile Chinook will be sampled per site (lethal take) for chemical analysis. An additional 30 fish will be handled to measure length and weight. The remaining Chinook salmon caught will be immediately released. In addition, up to 30 juvenile coho salmon, 10 juvenile chum salmon and 10 juvenile pink salmon will be sampled per site for chemical analysis. Based on studies by Brennan et al (2004) conducted in the same geographic area of Puget Sound, approximately 25% of captured juvenile Chinook in 2001 and 2002 via beach seine were unmarked (wild), 75% were of hatchery origin. We will use these figures as an estimate of our take of juvenile Chinook (Table 1). The total annual take we estimate is based on the number of beach seine sets during peak juvenile salmon outmigration.

Sampling period: March of 2006, biweekly during the spring salmonid outmigration period (March-June), and then monthly until October due to the relatively low fish residence in nearshore Puget Sound during late fall and winter (Wingert and Miller 1979, Borton 1982).

2. Every effort will be made to minimize injury or mortality to the captured fish. All personnel involved in this project have considerable experience capturing and handling fish in ways to reduce stress. However, there is the potential for abrasion, scale loss, and internal injury as the fish are captured. Any obviously injured fish will be part of samples taken for necropsy as described above. Upon retrieval of the net, fish will be identified, counted and immediately released, or placed immediately in aerated tanks until they can be properly handled, recorded, and released in as gentle and timely manner as possible to minimize stress.

## H. Description and Estimates of Take

Summaries of estimated annual take are listed in Table 1. We are targeting artificially-produced and naturally-propagated juvenile Chinook salmon (*Oncorhynchus tshawytscha*) from Puget Sound and surrounding areas. Since all wild juvenile Chinook salmon and a majority of the hatchery juvenile Chinook salmon from the areas we are sampling are listed, we are taking the conservative approach that all of the Chinook salmon we capture are listed. We believe this is the most appropriate approach to take due to the lack of accurate juvenile production information, especially on an in-season basis. Any salmonids dead in the beach seines upon their retrieval will be used for the necropsy (lethal take) analyses. Numbers listed in the incidental mortality column for capture/handle/release categories represent an allowance for delayed mortalities following release. These cannot be directly assessed.

1. A description of the recent status and trends.

a. Chinook salmon

A recovery plan for the Puget Sound Chinook salmon ESU was recently published (www.sharedsalmonstrategy.org/plan/index.html). A summary of this information is provided in Chapter 2 of this plan (see Figure 2.8, page 48) while greater details can be obtained in chapters for individual watersheds. Overall, most Puget Sound Chinook salmon populations are at no better than historic levels and in some cases as low as 1% of historic levels.

2. A summary table. (See Table 1). Estimates of potential annual mortalities by take category are provided in Table 1 for all six sampling areas combined.
3. The following steps were conducted to estimate take:

a. Our approach was to compute a maximum expected take for each year for the entire study region. We first projected a maximum likely monthly catch of salmon each month. Based on prior Puget Sound studies (Fresh et al 1979, Mavros and Brennan 2001, Olson et al 2006), we estimate an average Chinook salmon catch of 10 fish per beach seine set during the peak salmonid runs (April – June). Hatchery fish are often the dominant portion of the catch in areas south of the Skagit River basin based on these studies.

b. To our knowledge, there is no information on handling mortality of fish caught in beach seines. Therefore, we assumed a 3% mortality of salmon caught and released based upon our collective experience and consultations with other fisheries scientists doing similar work in the region.

## I. Transportation and Holding

Listed fish will not be transported or held live in the course of this project.

## J. Cooperative Breeding Program

We are willing to participate in a cooperative breeding program and to maintain or contribute data to a breeding program, if such action is requested.

## K. Previous or Concurrent Activities Involving Listed Species

The principal investigator, O. Paul Olson, has not held ESA permits to take listed fish in the past, but has been handling fish in association with fisheries research for 27 years (see attached CV).

## L. Certification

"I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief. I understand this information is submitted for the purpose of obtaining a permit under the Endangered Species Act of 1973

(ESA) and regulations promulgated thereunder, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or to penalties under the ESA."

_______________________________________ __________________

Tracy K. Collier
Division Director
Environmental Conservation Division

Date

**M. Length of Time and Cost to Prepare Application**

1. Length of time in hours: 30
**2.** Estimate of Cost: $1,000

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**Table 1.** Estimated annual take and mortality for listed Puget Sound juvenile salmonids for 2006-2010.

| ESU/Species | Origin | Life Stage | Take Activity | Requested Number Fish to be Taken | Research Location | Research Period |
|---|---|---|---|---|---|---|
| Puget Sound Chinook salmon | wild | Juvenile | Capture, handle, release | 140 | South Puget Sound | March - October |
| Puget Sound Chinook salmon | wild | Juvenile | Capture, handle, release | 70 | North Puget Sound | March - October |
| Puget Sound Chinook salmon | wild | Juvenile | Intentional mortality | 60 | South Puget Sound | March - October |
| Puget Sound Chinook salmon | wild | Juvenile | Intentional mortality | 30 | North Puget Sound | March - October |
| Puget Sound Chinook salmon | hatchery | Juvenile | Capture, handle, release | 160 | South Puget Sound | |
| Puget Sound Chinook salmon | hatchery | Juvenile | Capture, handle, release | 80 | North Puget Sound | |
| Puget Sound Chinook salmon | hatchery | Juvenile | Intentional mortality | 500 | South Puget Sound | March - October |
| Puget Sound Chinook salmon | hatchery | Juvenile | Intentional mortality | 250 | North Puget Sound | March - October |

**Table 2.** Sampling site locations with Latitude and Longitude

| Site | Latitude | Longitude |
|---|---|---|
| Seattle, WA, Duwamish River, Kellog Island | 47°33'25.2"N | 122°20'44.2"W |
| Seattle, WA, Elliot Bay, Myrtle Edwards Park | 47°37'06.7'"N | 122°21'39.0"W |
| Seattle, WA, Shilshole Bay | 47°40'18.0'"N | 122°24'37.3"W |
| Edmonds, WA | 47°48'54.1'"N | 122°22'49.2"W |
| Mukilteo, WA | 47°57'01.5'"N | 122°17'48.8"W |
| Everett, WA | 47°58'10.0'"N | 122°13'56.4"W |

**Figure 1.** Map of the sampling site locations